Psoraleeae (12.01–12.09)

Genus: *Cullen* F.C. Medikus

Phylogenetic Number: 12.01.

Tribe: Psoraleeae.

Species Studied—Species in Genus: 10 spp.—32 spp.

Fruit a legume; unilocular; 0.25–0.7 × 0.15–0.35 × 0.1–0.5 cm; with persistent calyx; with calyx longer than fruit; without orifice formed by curving of fruit or fruit segments; straight to curved; not plicate; not twisted; asymmetrical or symmetrical; oblong or reniform; when asymmetrical with both sutures parallelly or unequally curved; partially inflated or not inflated; compressed; without beak; short tapered to rounded at apex; apex aligned to oblique to right-angled (nearly) with longitudinal axis of fruit; rounded at base; base aligned to oblique with longitudinal axis of fruit; with the apex and base uniform in texture; membranous; seed chambers externally visible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit indehiscent. Replum invisible. Epicarp dull; monochrome; black or red (brownish often concealed by deciduous white hairs); glabrous, pubescent and indurate, or pubescent but soon deciduous; with 1 type of pubescence; with pubescence gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; glandular or eglandular; without spines; not smooth; with elevated or recessed features; veined or not veined; transversely veined relative to fruit length; not tuberculate; scaly or wrinkled; glandularly punctate; exfoliating in part or not exfoliating; without cracks. Mesocarp absent. Endocarp absent. Seed 1; length parallel with fruit length. Funiculus less than 0.5 mm long; filiform; straight. Aril present or absent; dry; rim-aril; white.

Seed 2.5–5 × 1.5–3.5 × 1–2.5 mm; not overgrown; not angular; asymmetrical; reniform; compressed; with or without visible radicle and cotyledon lobes; without umbo on seed faces. Testa with pieces of adhering epicarp; partially adhering to endocarp; somewhat glossy; not modified by a bloom; colored; monochrome or mottled; with frequent mottles; reddish brown or green (brownish); with brownish black overlay; glabrous; smooth (when partially adhering endocarp not considered); coriaceous. Fracture lines absent. Rim absent. Raphe not visible. Hilum fully concealed; concealed by funiculus or funicular remnant; without faboid split; punctiform; marginal according to radicle tip; recessed; within corona. Hilum corona color lighter than testa (reddish to yellow). Lens not discernible. Endosperm thin; covering entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire over radicle; without lobes; with the interface division terminating in radicle tissue; without margins recessed; yellow; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; parallel to length of seed. Radicle linear; deflexed and parallel to cotyledon length; centered between cotyledons; 1/2 to nearly length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Africa through India and Sri Lanka to Burma, Philippines, Papua New Guinea, and Australia.

Notes: Stirton *(1981)* illustrated seeds and fruits of Amorpheae and Psoraleeae. Since Isely *(1962)* monographed the tribe for north-central United States the spelling of the tribe name has changed as well as the genera recognized in the tribe. *Amorpha* (6.04), *Dalea* (6.08), and *Petalostemon* A. Michaux (now part of *Dalea*) are now in the Amphoreae, and species in the remaining genus, *Psoralea* (12.09), have been assigned to several genera treated here. Grimes *(1990)* noted that this tribe "has been described as having indehiscent fruits. However, in many North American species the fruit is secondarily dehiscent (that is, not along sutures) by transverse rupture of the pod." This technically is not dehiscence. Stirton *(1981)* transferred six African species of *Psoralea* (12.09) to *Cullen.* The unit of dispersal may include the soon-deciduous to apparently permanent-papery-to-leathery 5-lobed calyx. The calyx bears reddish glands and may be glabrous to pubescent with silvery to golden hairs. Grimes *(1997)* revised *Cullen,* and his species count is used. He accepted it as monophyletic because all of its species have a small invagination of the epicarp just above the fruit stalk on the ventral side. The invagination only partially penetrates the epicarp. The fruit of *C. glandulosa* (C. Linnaeus) J.W. Grimes absices below the calyx and travels with it, while in *C. americanum* the fruit falls free of the calyx. The fruit of *C. glandulosa* is unusual among the studied species because the upper half is more or less inflated and the lower half is adnate to the testa.

Cullen: C. americanum (C. Linnaeus) P.A. Rydberg *(C–E), C.* spp. *(A–B). A,* Fruits with and without calyx (× 3.4); *B,* embryos with and without epicarp (× 5); *C–D,* exocarp (× 50, × 1000); *E,* embryos (× 10).

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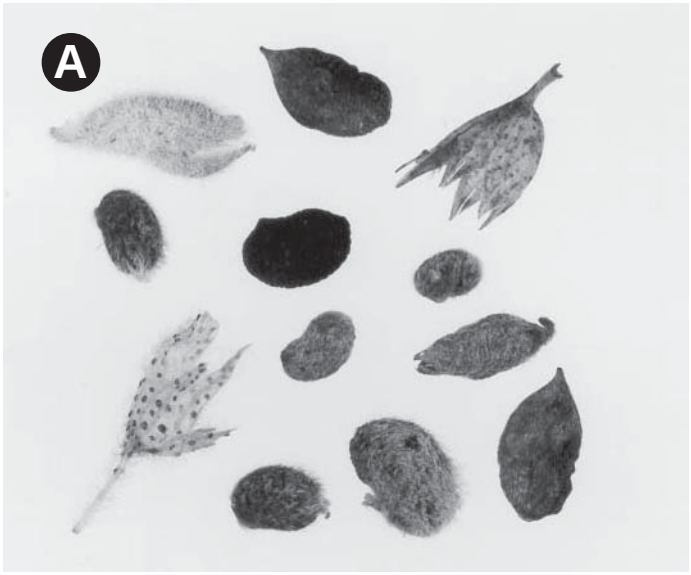

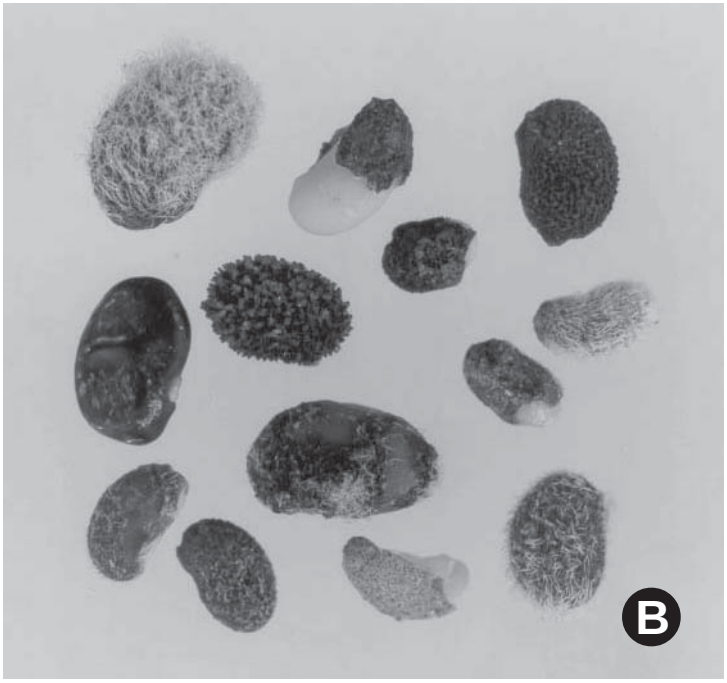

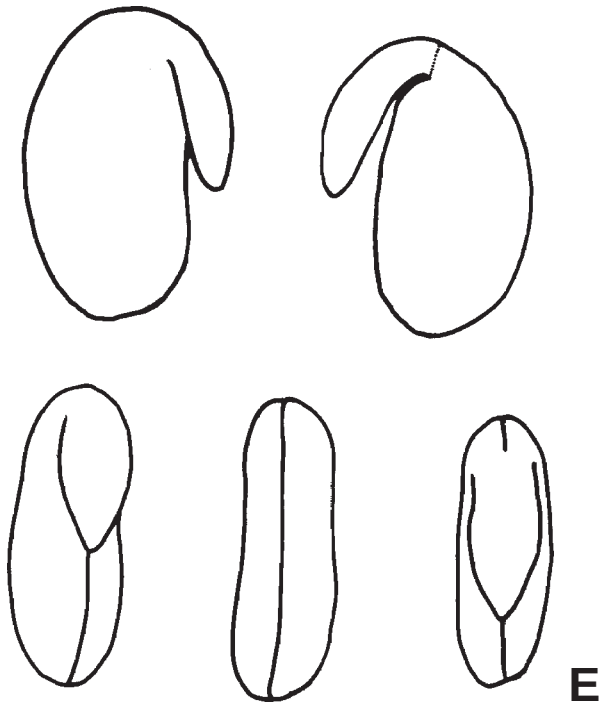

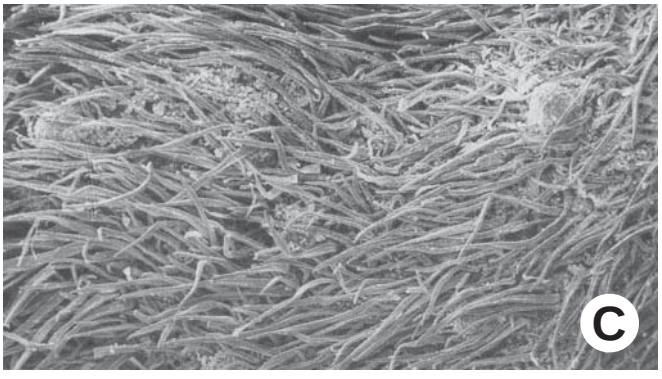

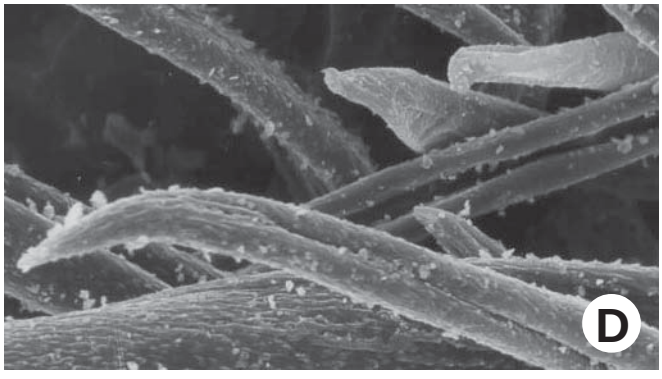

Genus: *Bituminaria* L. Heister ex P.C. Fabricius

Phylogenetic Number: 12.02.

Tribe: Psoraleeae.

Species Studied—Species in Genus: 1 sp.—2 spp.

Fruit a legume; unilocular; 0.4–0.6 (exclusive of fragile beak up to 1 cm long) × 0.3–0.4 × 0.2–0.3 cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; when asymmetrical with 1 straight and 1 curved suture; widest near middle or D-shaped; not inflated; compressed; with beak; declined; with papery fragile beak up to 1 cm long; truncate at apex (exclusive of beak); apex aligned with longitudinal axis of fruit; rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous or fragile, thinner than chartaceous like *Trifolium* (23.07); seed chambers externally visible. Fruit margin not constricted; without sulcus; embellished; with prickles. Fruit wings absent. Fruit nonstipitate. Fruit indehiscent or with all layers dehiscing (secondarily: see Notes). Replum invisible. Epicarp dull; multicolored; mottled; brown or gray; with red overlay (if spines knocked off); with surface texture uniform or not uniform, with patches of different texture not restricted to the base and apex; pubescent but soon deciduous and glabrous (except apex); with 1 type of pubescence; villous; with pubescence gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; glandular; with glandular dots (reddish brown); with spines (black on seed chamber); with spines persistent or broken off and their bases evident; with spines same color as or a different color (or their basal remanent) from the rest of the fruit; not smooth; with elevated or recessed features; not veined; not tuberculate; faintly wrinkled; glandularly punctate; not exfoliating; without cracks. Mesocarp thin; surface not veined; 2-layered; without balsamic vesicles; without fibers; with spongy layer over solid layer; coriaceous. Endocarp dull; monochrome; grayish black; smooth; nonseptate; coriaceous; not exfoliating; remaining fused to mesocarp and epicarp. Seed 1; length parallel with fruit length. Funiculus less than 0.5 mm long; straight. Aril absent.

Seed 3.5–4.5 × 2.5–3.5 × 1.5–2.5 mm; not overgrown; not angular; asymmetrical; D-shaped; quadrangular; without visible radicle and cotyledon lobes; without umbo on seed faces. Testa absent. Endosperm thin; covering entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire over radicle; without lobes; with the interface division terminating in radicle tissue; without margins recessed; dark tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; parallel to length of seed. Radicle linear; deflexed and parallel to cotyledon length; centered between cotyledons; 1/2 to nearly length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Mediterranean Europe, North Africa, and southwestern Asia.

Notes: Intact seeds of *B. bituminosa* do not exist free of the fruit because the testa is fused to the endocarp. Therefore, the testa, raphe, hilum, and lens characters could not be scored. The fruits have an aroma reminiscent of fenugreek (*Trigonella foenum-graecum*, 21.04).

Bituminaria: B. bituminosa (C. Linnaeus) C.H. Stirton *(A–E)*. *A*, Fruits (without beak and hairs, within calyx, and with beak and hairs) (× 4.9); *B*, embryo and two fruits functioning as seeds (× 8); *C–D*, exocarp (× 50, × 1000); *E*, embryos (× 8).

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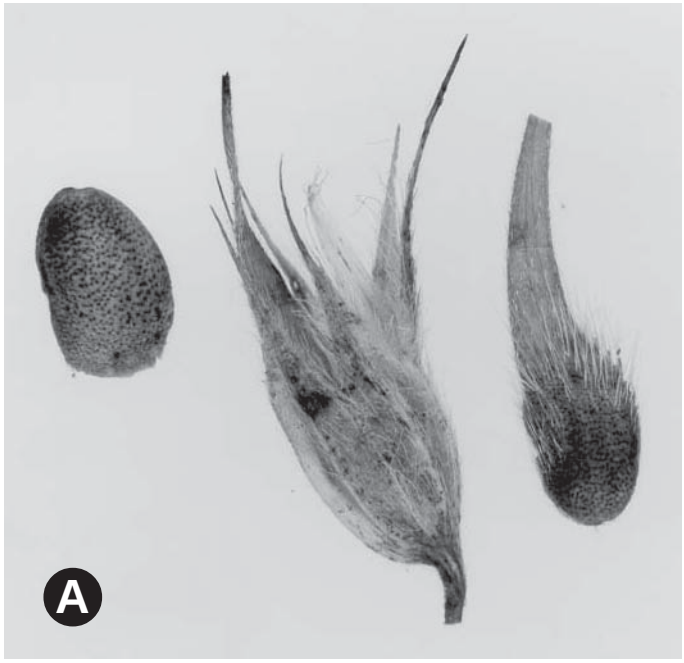
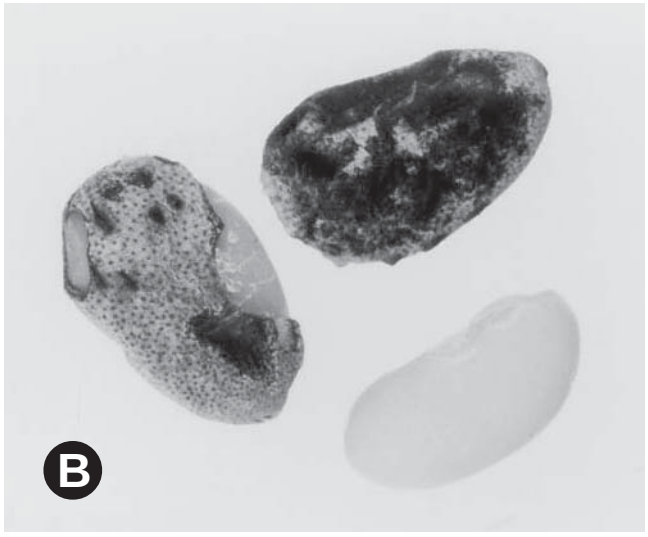
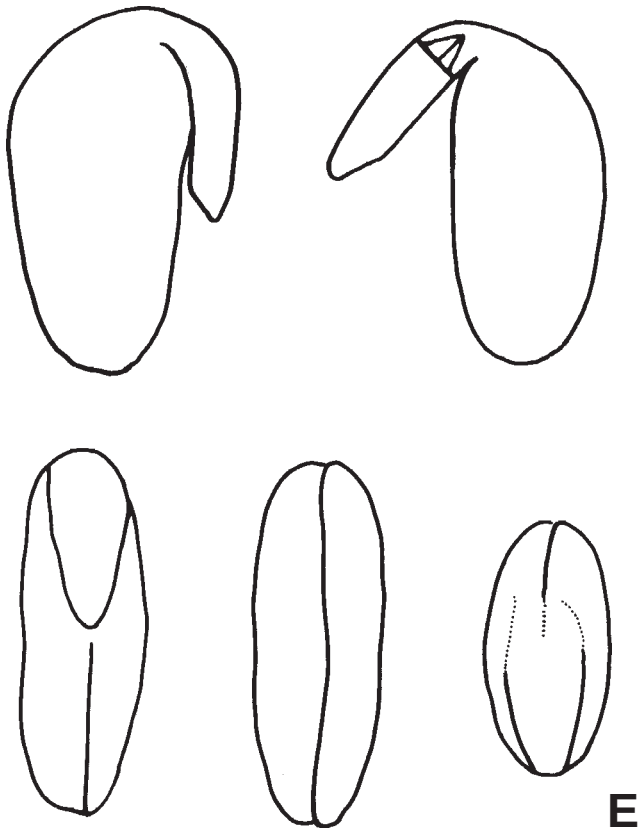
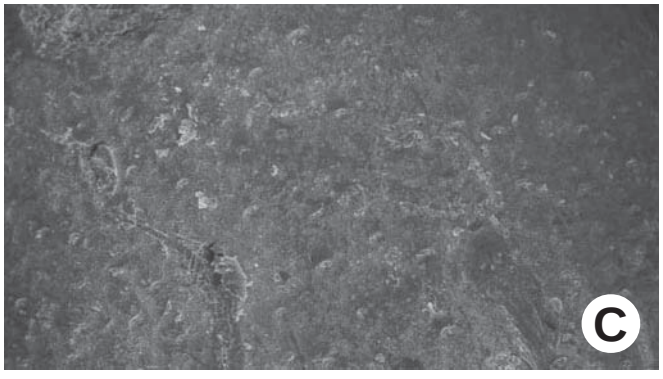
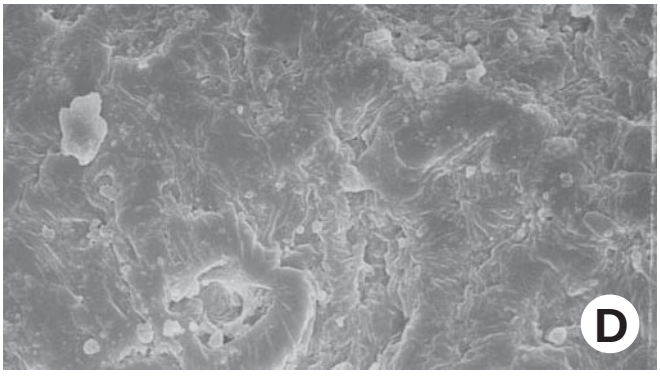










Genus: *Pediomelum* P.A. Rydberg

Phylogenetic Number: 12.03.

Tribe: Psoraleeae.

Species Studied—Species in Genus: 4 spp.—21 spp.

Fruit a legume; unilocular; 0.8–1.6 (including beak) × 0.4–0.5 × 0.2– 0.25 cm; with persistent calyx; with calyx shorter than fruit (but not beak); without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical or symmetrical (except beak); oblong; when asymmetrical with both sutures parallelly curved; not inflated; compressed; with beak; straight; with solid beak the same color and texture as fruit; long tapered or rounded at apex; apex aligned to oblique with longitudinal axis of fruit; rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform or differing in texture; upper 3/4 barely inflated, reticulate, and pubescent and lower 1/4 not inflated, reticulate, or pubescent; chartaceous or fragile, thinner than chartaceous like *Trifolium* (21.06); seed chambers externally visible. Fruit margin not constricted; without sulcus; plain or embellished; with thickened sutural areas (thickened margins). Fruit wings absent. Fruit substipitate to nonstipitate. Fruit indehiscent. Replum invisible. Epicarp dull; monochrome; red or tan; pubescent and indurate; with 1 type of pubescence; villous; with pubescence gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; glandular or eglandular; with glandular dots; limited to a portion of fruit; upper 3/4 glandular and lower 1/4 eglandular; without spines; not smooth; with elevated features; reticulately veined; not tuberculate; not exfoliating; without cracks. Mesocarp absent. Endocarp dull; monochrome; tan; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seed 1; length parallel with fruit length. Funiculus measured; less than 1 mm long; straight. Aril absent.

Seed 4.5–6 × 2.8–4 × 1.5–2.5 mm; not overgrown, 1 seed filling entire fruit cavity; not angular; symmetrical or asymmetrical; oblong; compressed; without visible radicle and cotyledon lobes; without umbo on seed faces. Testa partially adhering to endocarp (may have); glossy; not modified by a bloom; colored; monochrome or streaked; with frequent streaks; green (ish), red (brownish), tan, or yellow; with black (faintly) or brown overlay; glabrous; smooth (*P. cyphocalyx* (A. Gray) P.A. Rydberg) or not smooth; with elevated or recessed features; wrinkled (*P. castoreum* (S. Watson) P.A. Rydberg); pitted with small separate pits (faintly and widely scattered); coriaceous. Fracture lines absent. Rim absent. Raphe not visible. Hilum fully concealed; concealed by funicular remnant; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; up to 0.6 mm long; with curved outline; circular or elliptic; marginal according to radicle tip; recessed; within corona or not within corona, halo, or rim. Hilum corona color lighter than testa. Lens discernible; equal to or greater than 0.5 mm in length; up to 0.5 mm long; with margins straight or curved; linear, circular, or oblong; not in groove of raphe; adjacent to hilum; up to 0.2 mm from hilum; mounded; dissimilar color from testa; darker than testa; black; not within corona, halo, or rim. Endosperm thin (thinnest of all genera in tribe); covering entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire over radicle; without lobes; with the interface division terminating in radicle tissue; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; parallel to length of seed. Radicle linear; deflexed and parallel to cotyledon length; centered between cotyledons; 1/2 to nearly length of cotyledons. Plumule rudimentary; glabrous.

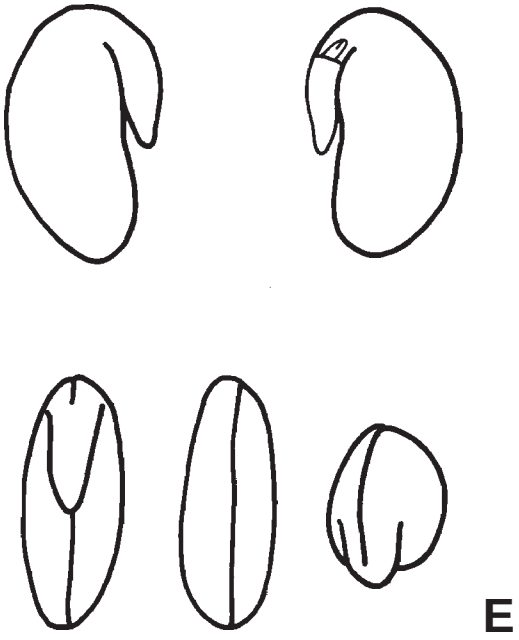
Distribution: North America, Mexico, and central and southern Africa.

Notes: Grimes *(1990)* recognized 21 species, and we are following his count. *Pediomelum argophyllum* (F.T. Pursh) J.W. Grimes and *P. castoreum* have beaks like *Bitumaria* (12.02), but their fruits are too fragile and were too few in number in our sample for our analysis to be considered complete.

Pediomelum: P. esculentum (F.T. Pursh) P.A. Rydberg *(C–E), P.* spp. *(A–B). A,* Fruits with and without calyx (× 3.2); *B,* seeds (× 6); *C–D,* testa (× 50, × 1000); *E,* embryos (× 6).


A


B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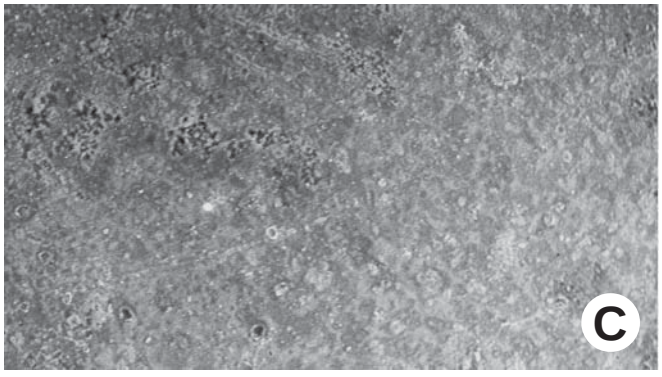
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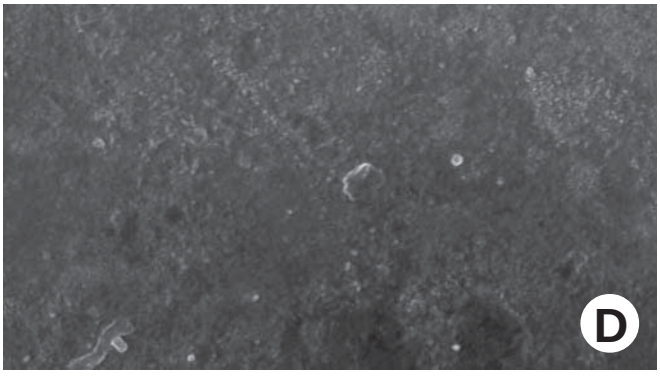
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Genus: *Psoralidium* P.A. Rydberg

Phylogenetic Number: 12.04.

Tribe: Psoraleeae.

Species Studied—Species in Genus: 2 spp.—13 spp.

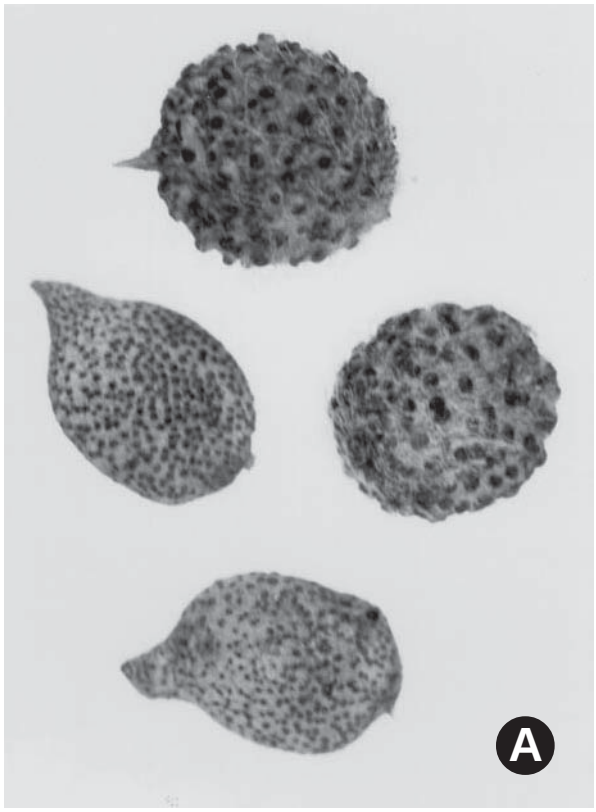
Fruit a legume; unilocular; 0.4–0.95 (including beak up to 3 mm long in *P. tenuifolium*) × 0.35–0.5 × 0.25–0.4 cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; circular, elliptic, or oblong; not inflated; compressed to terete; without or with beak; straight; with solid beak the same color and texture as fruit (*P. tenuifolium* (F.T. Pursh) P.A. Rydberg); rounded at apex; apex aligned to oblique with longitudinal axis of fruit; short tapered to rounded at base; base aligned to oblique with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit nonstipitate. Fruit indehiscent. Replum invisible. Epicarp dull; monochrome (but with well developed reddish-brown glands); tan; pubescent and indurate; with 1 type of pubescence; tomentose; with pubescence gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; glandular; with glandular dots; without spines; not smooth; with elevated or recessed features; not veined; tuberculate; glandularly punctate; not exfoliating; without cracks. Mesocarp absent. Endocarp dull; monochrome; tan; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp. Seed 1; length parallel with fruit length. Funiculus measured; up to 1 mm long; thick; straight. Aril absent.

Seed 3.4–5.5 × 3–3.5 × 2–3 mm; not overgrown; angular to not angular; symmetrical or asymmetrical; circular, irregular (many seeds have large, irregularly placed dimples), or oblong; terete to compressed; without visible radicle and cotyledon lobes; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome or streaked; with frequent streaks; brownish green or red (brownish); with purple overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 0.4 mm long; with curved or straight outline; elliptic or oblong; marginal according to radicle tip; flush; not within corona, halo, or rim. Lens discernible; equal to or greater than 0.5 mm in length; up to 0.6 mm long; with margins straight or curved; linear, elliptic, oblong, or key-hole shaped *(P. lanceolatum);* not in groove of raphe; confluent with hilum; recessed; dissimilar color from testa; darker than testa; black; not within corona, halo, or rim. Endosperm thin; covering entire embryo; adnate to testa. Cotyledons outer face of 1 cotyledon flat and other cotyledon concave; 1 thicker than the other; both more or less of equal length; with both or only 1 folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire over radicle; without lobes; with the interface division terminating in radicle tissue; without margins recessed; yellow or green; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; parallel to length of seed. Radicle linear; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Western Canada and western United States.

Notes: Our species count is based on Grimes *(1990).* The micropyle of *P. tenuiflorum* is bright reddish and therefore more conspicuous than the black lens.

Psoralidium: P. lanceolatum (F.T. Pursh) P.A. Rydberg *(C–E), P.* spp. *(A–B). A,* Fruits (× 6.7); *B,* seeds (× 7.8); *C–D,* testa (× 50, × 1000); *E,* embryos (× 6).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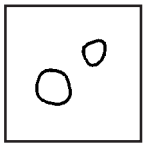


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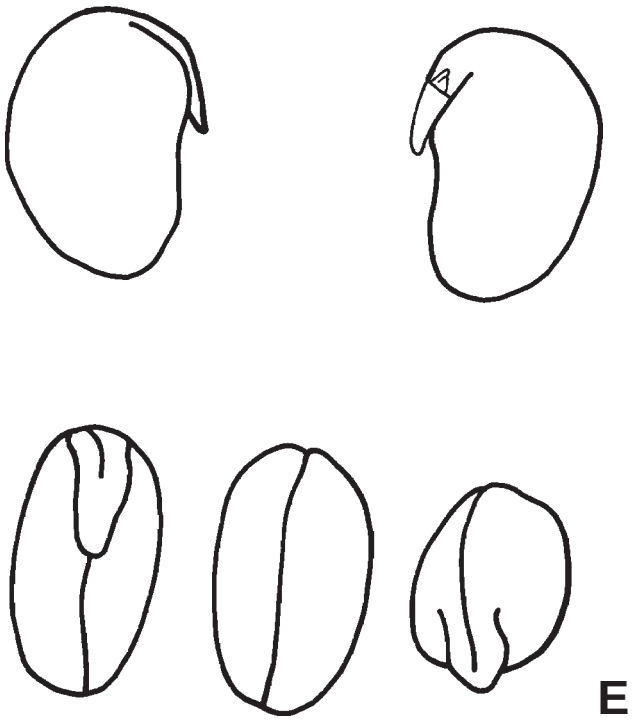
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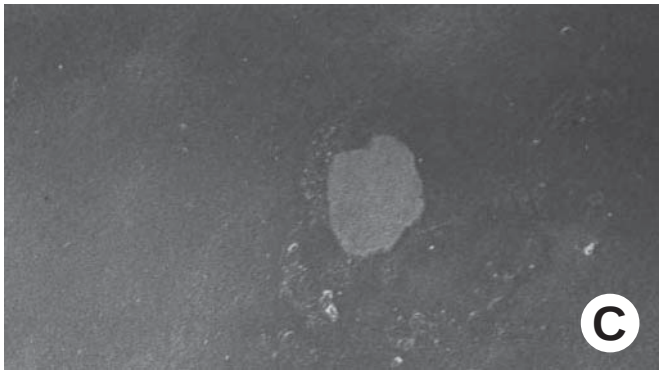
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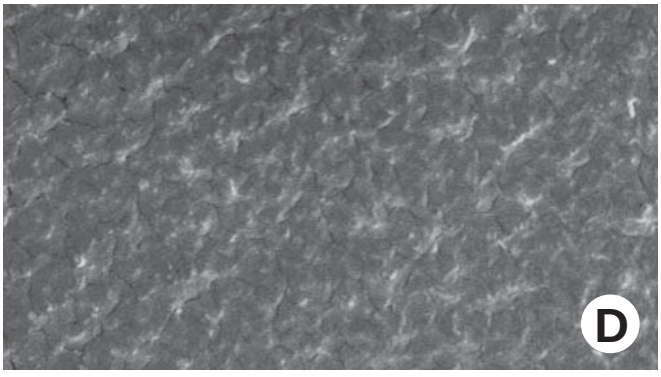
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Genus: *Rupertia* J.W. Grimes

Phylogenetic Number: 12.05.

Tribe: Psoraleeae.

Species Studied—Species in Genus: 2 spp.—3 spp.

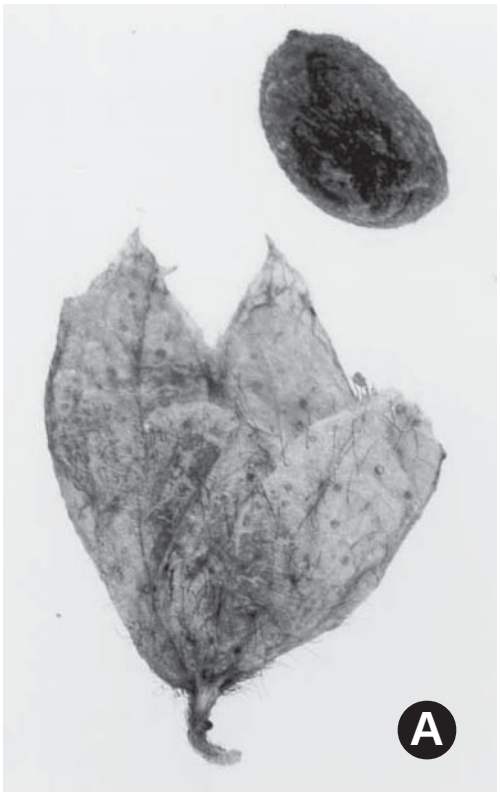
Fruit a legume; unilocular; 0.4–0.7 × 0.3–0.5 × 0.27 cm; with persistent calyx; with calyx equal in length to fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; elliptic; not inflated; compressed; without *(R. physodes)* or with beak; with solid beak the same color and texture as fruit (beak 1–3 mm long in *R. hallii* (P.A. Rydberg) J.W. Grimes and *R. rigida* (S.B. Parish) J.W. Grimes); short tapered or rounded at apex; apex aligned with longitudinal axis of fruit; rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform; chartaceous; seed chambers externally visible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit indehiscent. Replum invisible. Epicarp dull; monochrome; tan; pubescent and indurate; with 1 type of pubescence; puberulent; with pubescence gray or brown; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; glandular or eglandular; with glandular dots (golden and fading with age); without spines; not smooth; with elevated features; veined or not obliquely veined relative to fruit length (at least lower one-half); not tuberculate; wrinkled; not exfoliating; without cracks. Mesocarp absent. Endocarp dull; monochrome; tan; spongy; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp. Seed 1; length parallel with fruit length. Funiculus measured; less than 1 mm long; thick; straight. Aril absent.

Seed 4.5–7 × 2.7–4 × 1.7 mm; not overgrown; not angular; asymmetrical; reniform; compressed; without visible radicle and cotyledon lobes; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; brownish red; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 0.8 mm long; with curved outline; circular; marginal according to radicle tip; recessed; within corona. Hilum corona color darker than testa. Lens discernible; equal to or greater than 0.5 mm or less than 0.5 mm in length; 0.5 mm long; with margins straight; wedge-shaped; not in groove of raphe; confluent with hilum; flush; dissimilar color from testa; darker than testa; black; within corona. Lens corona color darker than testa. Endosperm absent. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire over radicle; without lobes; with the interface division terminating in radicle tissue; green; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; parallel to length of seed. Radicle linear; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Western Canada and United States to Mexico (Baja California).

Notes: Grimes *(1990)* founded the genus.

Rupertia: R. physodes (D. Douglas ex W.J. Hooker) J.W. Grimes *(A–E). A*, Fruits with and without calyx (× 6); *B*, seed (× 8.5); *C–D*, testa (× 50, × 1000); *E*, embryos (× 10).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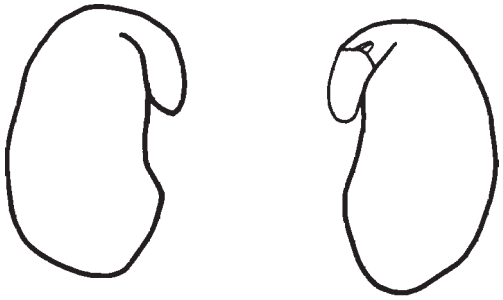

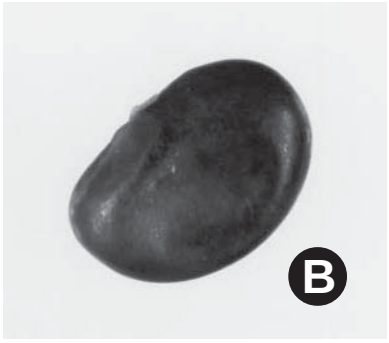
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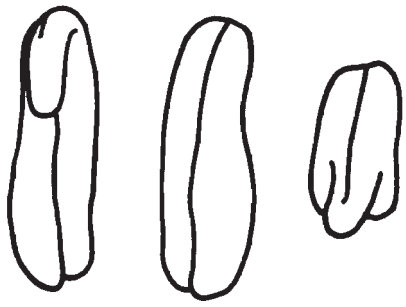
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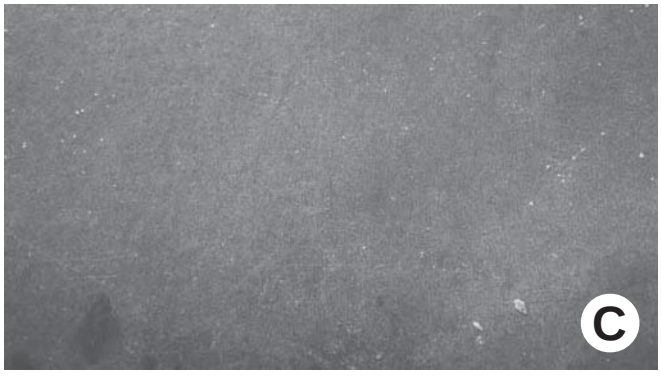
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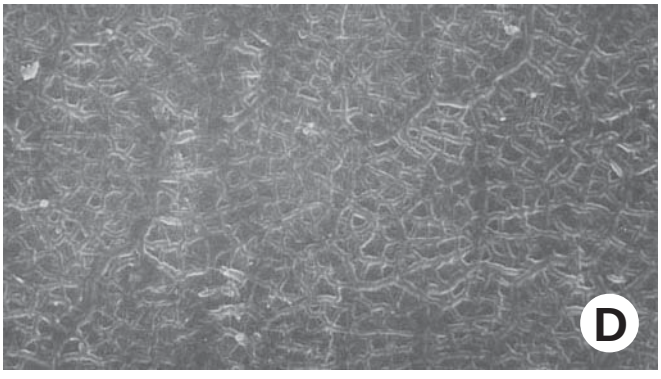
D

Genus: *Hoita* P.A. Rydberg

Phylogenetic Number: 12.06.

Tribe: Psoraleeae.

Species Studied—Species in Genus: 3 spp.—3 spp.

Fruit a legume; unilocular; 0.6–1 × 0.3–0.5 × 0.2–0.25 cm; with persistent or deciduous calyx; with calyx longer or shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical; when asymmetrical with 1 straight and 1 curved suture; widest near middle or D-shaped; barely inflated or not inflated; compressed; without beak; short tapered at apex; apex aligned with longitudinal axis of fruit; rounded at base; base oblique with longitudinal axis of fruit; with the apex and base differing in texture; upper 3/4 barely inflated, reticulate, and pubescent and lower 1/4 not inflated, reticulate, or pubescent; chartaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit indehiscent. Replum invisible. Epicarp dull; monochrome; brown; pubescent and indurate; with 1 type of pubescence; pilose; with pubescence golden; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; glandular; with glandular dots; limited to a portion of fruit; upper 3/4 glandular and lower 1/4 eglandular; without spines; not smooth; with elevated features; veined or not veined; transversely veined relative to fruit length; not tuberculate; not exfoliating; without cracks. Mesocarp absent. Endocarp dull; monochrome; tan; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seed 1; length parallel with fruit length. Funiculus measured; less than 1 mm long; thick; straight. Aril absent.

Seed 5.5–6.7 × 3.5–3.7 × 2–2.5 mm; not overgrown; not angular; symmetrical (except for hilum); elliptic; compressed; without visible radicle and cotyledon lobes; without umbo on seed faces. Testa not adhering to endocarp; glossy; not modified by a bloom; colored; monochrome or streaked; with frequent streaks; dark reddish brown; with brown (in dark, broad bands) overlay; glabrous; smooth or not smooth; with recessed features; pitted with small separate pits (some seeds with numerous pits and other seeds with few to no pits *H. strobilina* (J.W. Hooker & G.A. Arnott) G.A.W. Rydberg); coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum visible (with conspicuous light tan rim); with faboid split; with the lips of the faboid split the same color as the rest of the hilum; punctiform; marginal according to radicle tip; recessed; within rim. Hilum rim color lighter than testa. Lens not discernible. Endosperm thin; covering entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire over radicle; without lobes; with the interface division terminating in radicle tissue; without margins recessed; yellow; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; parallel to length of seed. Radicle linear; deflexed and parallel to cotyledon length; centered between cotyledons; 1/2 to nearly length of cotyledons. Plumule moderately developed; glabrous.

Distribution: Canada, western United States, and Mexico (Baja California).

Notes: Our species count is based on Grimes *(1990).*

Hoita: H. macrostachys (A.-P. de Candolle) P.A. Rydberg *(C–E), H.* spp. *(A–B). A,* Fruits and fruit in calyx (× 4.5); *B,* seeds (× 8); *C–D,* testa (× 50, × 1000); *E,* embryos (× 6).

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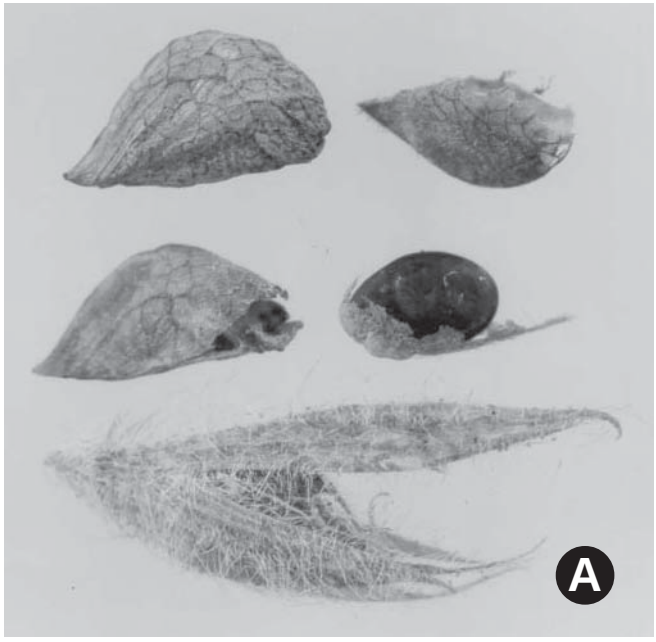
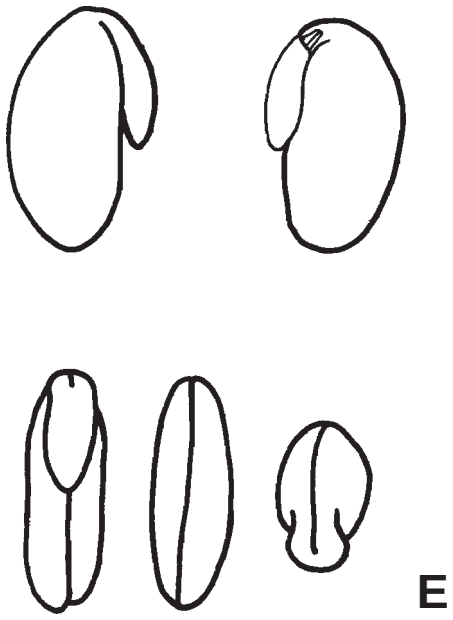
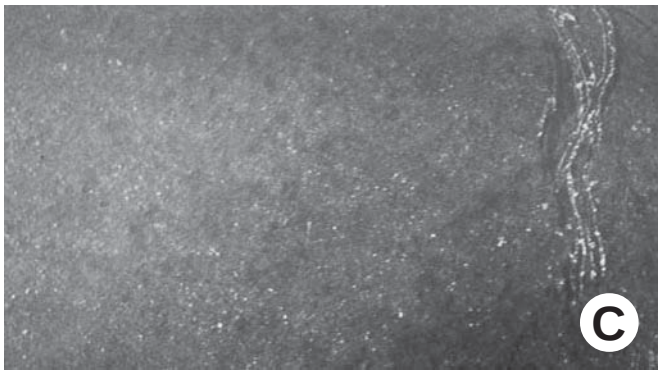
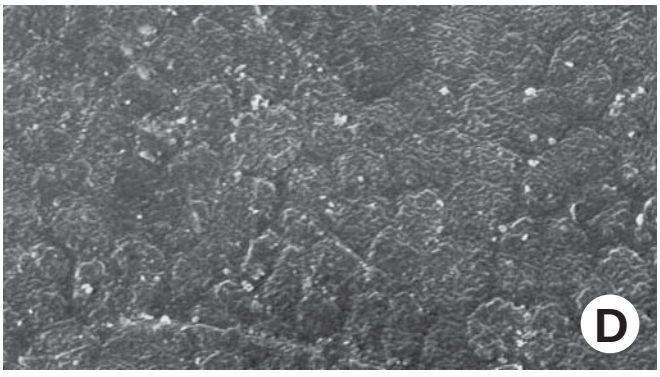








Genus: *Orbexilum* C.S. Rafinesque-Schmaltz

Phylogenetic Number: 12.07.

Tribe: Psoraleeae.

Species Studied—Species in Genus: 6 spp.—8 spp.

Fruit a legume; unilocular; 0.3–1.2 × 0.3–0.65 × 0.3 cm; with persistent or deciduous calyx; with calyx shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical or symmetrical; circular or obovate; when asymmetrical with 1 straight and 1 curved suture; widest near middle or D-shaped; not inflated; compressed; without or with beak; straight; with solid beak the same color and texture as fruit; short tapered to rounded at apex; apex aligned (with 3–4 mm long beak) or right-angled with longitudinal axis of fruit; short tapered to rounded at base; base aligned to oblique with longitudinal axis of fruit; with the apex and base uniform in texture; coriaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit indehiscent. Replum invisible. Epicarp dull; monochrome; brownish black, brown, or green; glabrous to glabrate to pubescent and indurate; with 1 type of pubescence; puberulent; with pubescence gray; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; glandular or eglandular; with glandular dots; without spines; not smooth; with elevated features; obliquely veined relative to fruit length or reticulately veined; not tuberculate; papillose or rugose; not exfoliating; without cracks. Mesocarp thin; 1-layered; without balsamic vesicles; without fibers; solid; coriaceous. Endocarp dull; monochrome; brown; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to mesocarp and epicarp; entire. Seed 1; length parallel with fruit length. Funiculus measured; less than 1 mm long; thick; straight. Aril absent.

Seed 2–7 × 2–4 × 2.5 mm; not overgrown; not angular; asymmetrical; ovate or reniform; compressed to terete (nearly); without visible radicle and cotyledon lobes; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome; black or brown (reddish); glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Raphe not visible. Hilum visible; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 0.6 mm long; with curved outline; circular; marginal according to radicle tip; flush; not within corona, halo, or rim. Lens not discernible. Endosperm thin; covering entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire or split over radicle; without or with lobes; with the interface division terminating in radicle tissue; without margins recessed; tan; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; parallel to length of seed. Radicle linear; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

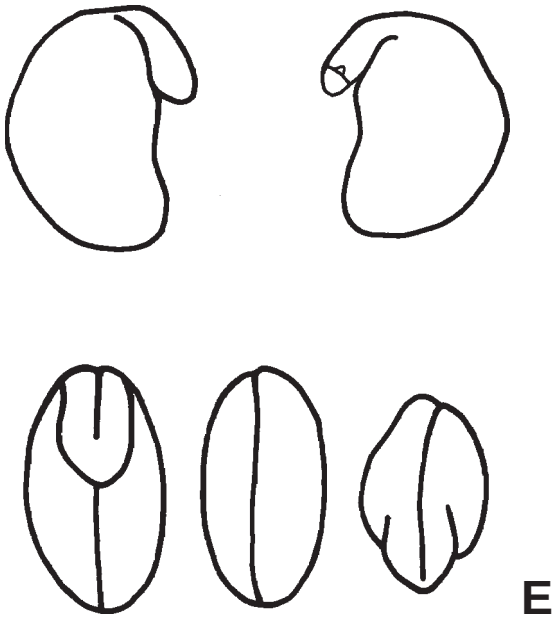
Distribution: North America and Mexico.

Notes: Stirton *(1981)* noted that "*Orbexilum* is all that remains of *Psoralea* s.l." when other segregate genera including *Psoralea* s.s. (12.09) are removed. "Furthermore, *Orbexilum* is clearly an unsatisfactory assemblage of plants." The species count and distribution are based on Grimes *(1990)*, who noted "*Orbexilum* is easily distinguished from all other Psoraleeae by its rugose fruits." Also, he classified fruits as rugose-ribbed, but in *O. onobrychis* (T. Nuttall) P.A. Rydberg fruits are papillate.

Orbexilum: O. pedunculatum (P. Miller) A.M. Vail *(C–E)*, *O.* spp. *(A–B)*. *A*, Fruits with and without calyx (× 3.8); *B*, seeds (× 7.6); *C–D*, testa (× 50, × 1000); *E*, embryos (× 10).


A


B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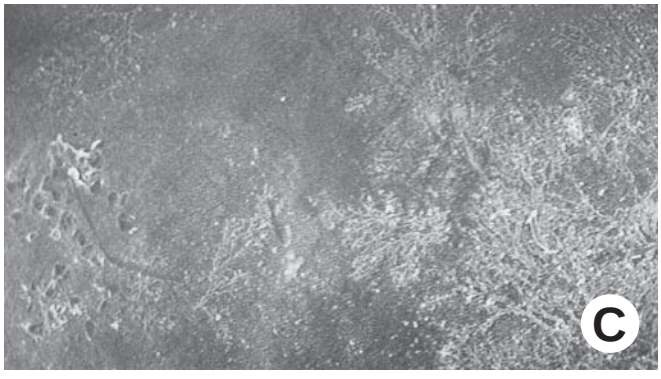
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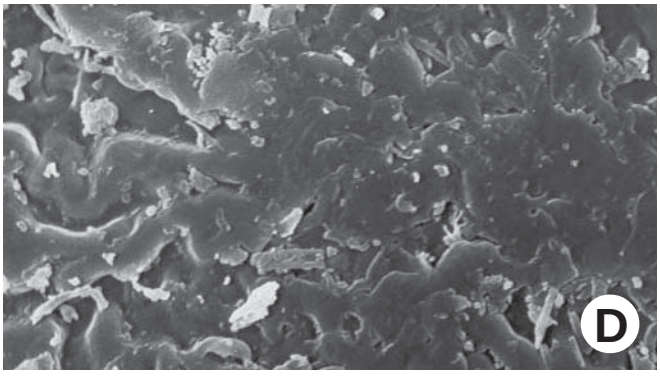

D

Genus: *Otholobium* C.H. Stirton

Phylogenetic Number: 12.08.

Tribe: Psoraleeae.

Species Studied—Species in Genus: 15 spp.—ca. 45 spp.

Fruit a legume; unilocular; 0.45–1.6 (including beak) × 0.25–0.5 × 0.25–0.3 cm; with persistent or deciduous calyx; with calyx longer than to equal in length to shorter than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; asymmetrical or symmetrical; circular, oblong, or obovate; when asymmetrical with both sutures parallelly curved; not inflated; compressed; with beak; straight; with solid beak (flat, 2 mm long) the same color and texture as fruit; short tapered to rounded at apex; apex right-angled with longitudinal axis of fruit; rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform or differing in texture; upper 1/2 inflated and reticulate over seed cavity and lower 1/2 adnate and wrinkled to scurfy over seed cavity (*O. glandulosa* (C. Linnaeus) J.W. Grimes); chartaceous; seed chambers externally invisible. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit indehiscent. Replum invisible. Epicarp dull; monochrome; tan; pubescent and indurate; with 1 type (gray) or 2 types of pubescence; pilose or puberulent; with pubescence gray and brown or brown (dark); with appressed dark brown hairs and scattered erect gray hairs intermixed; with pubescence uniformly distributed; with simple hairs; pliable; with hair bases plain; eglandular; without spines; not smooth; with elevated features; transversely veined relative to fruit length; not tuberculate; not exfoliating; with cracks; cracking transverse to fruit length. Mesocarp absent. Endocarp dull; monochrome; tan; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seed 1; length parallel with fruit length. Funiculus measured; less than 1 mm long; straight. Aril absent.

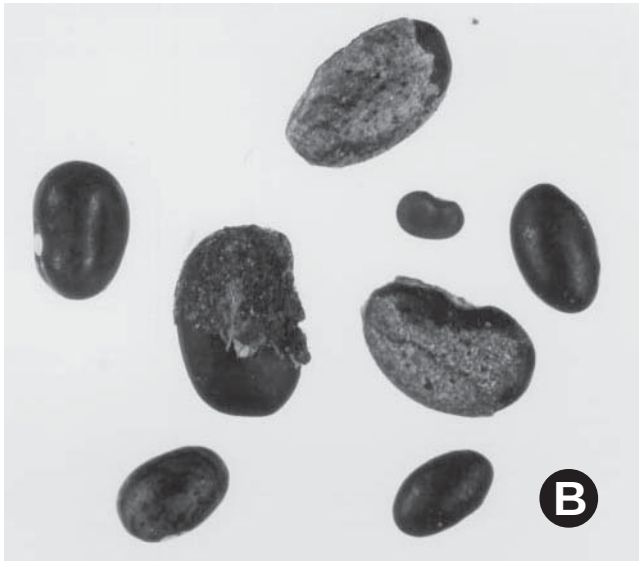
Seed 3–6 × 2–3 × 2 mm; not overgrown; not angular; asymmetrical; oblong; terete (to subterete); without visible radicle and cotyledon lobes; without umbo on seed faces. Testa partially adhering to endocarp (*O. pubescens* (J.L.M. Poiret) J.W. Grimes); nearly glossy; not modified by a bloom; colored; monochrome or mottled; with frequent mottles; tannish olive or brown (reddish); with black overlay; glabrous; smooth or not smooth; with elevated features; heavily wrinkled; coriaceous. Fracture lines absent. Rim absent. Wings absent. Raphe not visible. Hilum fully concealed; concealed by funicular remnant; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 0.5 mm long; with curved outline; circular; marginal according to radicle tip; flush; not within corona, halo, or rim. Lens not discernible. Endosperm thin; covering entire embryo; adnate to embryo. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; split over radicle; with lobes; with the interface division terminating in radicle tissue; without margins recessed; yellow; inner face flat; glabrous around base of radicle. Embryonic axis deflexed; parallel to length of seed. Radicle linear; deflexed and parallel to cotyledon length; centered between cotyledons; 1/2 to nearly length of cotyledons. Plumule rudimentary; glabrous.

Distribution: Southeastern and eastern Africa into South Africa (zone of Mediterranean vegetation) and South America (8 spp.).

Notes: The species count and distribution are based on Grimes *(1990)*, who noted 8 species in South America and about 35 species in the Old World. Stirton *(1986a)* reviewed *Otholobium* and named two new species from southeastern Africa (Stirton *1990*). The Old World species need to be revised. Stirton noted that the "morphology of the fruiting calyx and fruit of *O. sericeum* (J.L.M. Poiret) C.H. Stirton are quite different from that of the type species" (*O. caffrum* (C.F. Ecklon & C.L.P. Zeyher) C.H. Stirton).

Otholobium: O. hirtum (C. Linnaeus) C.H. Stirton *(C–E)*, *O.* spp. *(A–B)*. *A*, Fruits with and without calyx (× 3.3); *B*, seeds some with adhering epicarp (× 6); *C–D*, testa (× 50, × 1000); *E*, embryos (× 10).


A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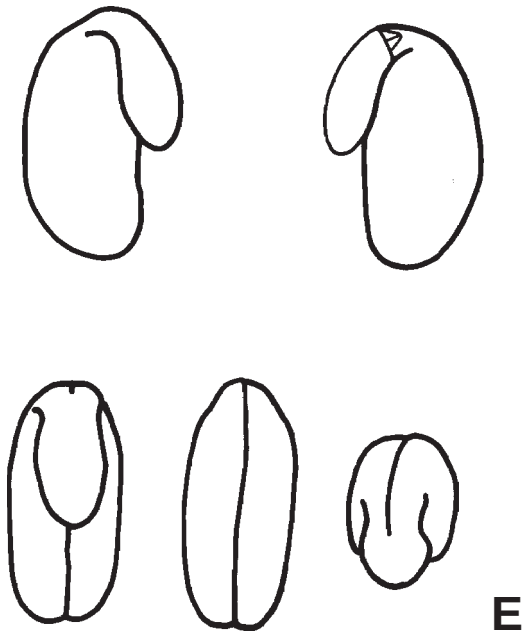
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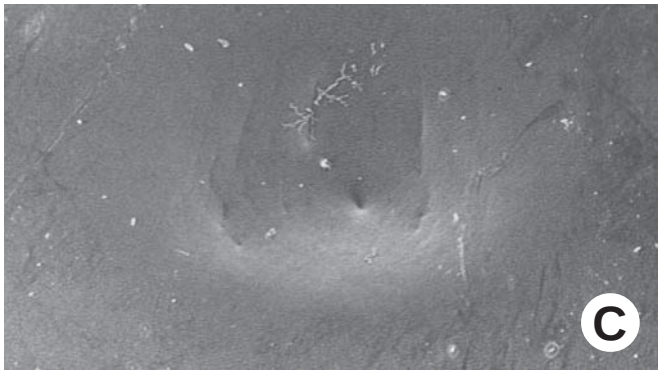
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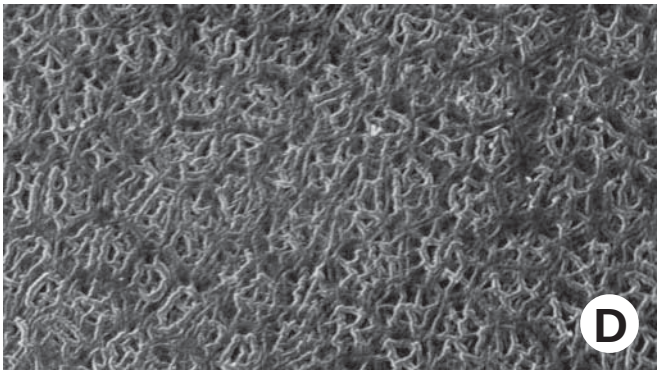
D

Genus: *Psoralea* C. Linnaeus

Phylogenetic Number: 12.09.

Tribe: Psoraleeae.

Species Studied—Species in Genus: 7 spp.—ca. 20 spp.

Fruit a legume; unilocular; 0.3–0.6 (including beak) × 0.2–0.4 × 0.15– 0.2 cm; with persistent calyx; with calyx longer than fruit; without orifice formed by curving of fruit or fruit segments; straight; not plicate; not twisted; symmetrical; elliptic; not inflated; terete; with beak (0.7-0.8 mm long); straight, or declined; with solid beak the same color and texture as fruit; rounded at apex; apex aligned with longitudinal axis of fruit; rounded at base; base aligned with longitudinal axis of fruit; with the apex and base uniform in texture; chartaceous or fragile, thinner than chartaceous like *Trifolium* (21.06); seed chambers externally visible; with the raised seed chambers not torulose. Fruit margin not constricted; without sulcus; plain. Fruit wings absent. Fruit nonstipitate. Fruit indehiscent. Replum invisible. Epicarp dull; monochrome; gray or brown; with surface texture uniform; glabrous or pubescent but soon deciduous; with 1 type of pubescence; eglandular; without spines; not smooth; with elevated features; irregularly veined (not aligned); not tuberculate; wrinkled; not exfoliating; without cracks. Mesocarp absent. Endocarp dull; monochrome; gray; smooth; nonseptate; chartaceous; not exfoliating; remaining fused to epicarp; entire. Seed 1; length parallel with fruit length. Funiculus less than 0.5 mm long; straight. Aril dry; rim-aril; tan.

Seed 3–3.5 × 1.7–2 × 1.5 mm; not overgrown; not angular; symmetrical (except hilum); oblong; terete; without visible radicle and cotyledon lobes; without umbo on seed faces. Testa not adhering to endocarp; dull; not modified by a bloom; colored; monochrome or mottled; with frequent mottles; brown; with black overlay; glabrous; smooth; coriaceous. Fracture lines absent. Rim absent. Raphe not visible. Hilum fully concealed; concealed by aril; with faboid split; with the lips of the faboid split the same color as the rest of the hilum; larger than punctiform; 0.6 mm long; with curved outline; elliptic; marginal according to radicle tip; flush; within corona or not within corona, halo, or rim. Hilum corona color lighter than testa. Lens discernible; equal to or greater than 0.5 mm in length; 0.5 mm long; with margins straight; linear; not in groove of raphe; confluent with hilum; recessed; dissimilar color from testa; darker than testa; black; within corona. Lens corona color lighter than testa. Endosperm thin; covering entire embryo; adnate to testa. Cotyledons smooth; both outer faces convex; both the same thickness; both more or less of equal length; not folded; margin entire 180 degrees from base of radicle; similar at apex; not concealing radicle; entire over radicle; without lobes; with the interface division terminating in radicle tissue; without margins recessed; yellow; inner face flat; glabrous around base of radicle. Embryonic axis straight; parallel to length of seed. Radicle linear; deflexed and parallel to cotyledon length; centered between cotyledons; less than 1/2 length of cotyledons. Plumule rudimentary; glabrous.

Distribution: South Africa.

Notes: Stirton *(1981)* considered *Psoralea* to be an artificial assemblage and redefined it to include approximately 20 species, all endemic to South Africa. He accepted the genus *Hallia* (12.09) with nine species but later (Tucker and Stirton *1991*, Polhill *1994b*, Crow et al. *1997*) expressed the opinion that it is a subgenus of *Psoralea*, *P.* subgenus *Hallia* (C.P. Thunberg) T.M. Salter. Grimes *(1990)* concurred with Stirton and transferred all New World *Psoralea* species to various genera.

Psoralea: P. aphylla C. Linnaeus *(D–E)*, *P. pinnata* C. Linnaeus *(A–C, F)*. *A*, Calyx with a fruit inside and a cupulum (× 4.6); *B*, fruit without calyx (× 8.8); *C*, seeds (× 8); *D–E*, testa (× 50, × 1000); *F*, embryos (× 10).

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